22

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(71)Applicant : NTT COMWARE CORP
(72)Inventor : KONNO TAKAHIRO

(54) RADIO COMMUNICATION DEVICEMETHOD THEREFORRADIO COMMUNICATION PROGRAM AND COMPUTER READABLE RECORDING MEDIUM RECORDED WITH THE SAME PROGRAM

(57)Abstract:
PROBLEM TO BE SOLVED: To calculate an index value presenting the optimal degree of respective routes from communication time for a plurality of routes and to perform radio communication while selecting the optimal route on the basis of the index value.
SOLUTION: A test frame is transmitted to a communicating party via a plurality of radio communication routes with the communicating partya response test frame is received from the communicating partyand the communication time from the transmission of the test frame to the reception of the response test frame is calculated for each of the plurality of routes. On the basis of the communication time for each routethe index value presenting the optimal degree of a radio communication quality in each of routes to the communicating party is calculated and on the basis of this index valuethe optimal route with the communicating party is selected. Thenthe radio communication is performed with the communicating party while selecting the optimal routethe optimal route with the communicating party is determined even during the radio communication and the radio communications are performed with the communicating party while successively selecting such and optimal route.

CLAIMS

[Claim(s)]
[Claim 1]Radio communication equipment which communicates while choosing

optimal course characterized by comprising the following.
A test signal transmitting means which transmits a test signal from this radio communication equipment to the communications-partner point via each of two or more radio courses between this radio communication equipment and the communications-partner point.
A reply signal reception means which receives a reply signal over said test signal replied via each of two or more of said radio courses from the communications-partner point.
A hour corresponding calculating means which computes hour corresponding from transmission of said test signal to reception of a reply signal for every each of two or more of said radio courses over the communications-partner point.
An index value calculating means which computes an index value which expresses an optimal degree of radio quality of each radio course to a partner communication destination based on hour corresponding of each radio course over this computed partner communication destination.

[Claim 2]The radio communication equipment comprising according to claim 1:
An optimal-path determination means to determine optimal radio course with this communications-partner point based on said index value computed by said index value calculating means about each of two or more radio courses between the communications-partner points which are going to communicate.
While choosing this determined optimal radio course and performing the communications-partner point and radioIt is an optimal-path sequential decision means during communication which controls to compute said index value one by one by said index value calculating means during this radio about each of two or more radio courses between the communications-partner pointsis based on this computed index valueand carries out sequential decision of the optimal radio course with the communications-partner point during radio.
An optimal-path sequential-selection means to perform said communications-partner point and radio while making during radio the sequential selection of this optimal radio course by which sequential decision is carried out.

[Claim 3]The radio communication equipment according to claim 1 or 2wherein said index value calculating means has a time-series-data conformity means to compute said index value based on time series data of hour corresponding of each radio course to said computed partner communication destination.
[Claim 4]Hour corresponding of the newest [means / said / time-series-data conformity] among said time series dataOr the radio communication equipment according to claim 3 having a data selection means which hour corresponding chooses two or more hour corresponding below a predetermined value among two or more newest hour corresponding or two or more newest hour correspondingand computes an index value based on this selected hour corresponding.
[Claim 5]Are a wireless communication method which communicates while choosing optimal courseand a test signal is transmitted from a communicating

agency this communication origin to the communications-partner point via each of two or more radio courses between the communications-partner pointsA reply signal over said test signal replied via each of two or more of said radio courses from the communications-partner point is receivedHour corresponding from transmission of said test signal to reception of a reply signal is computed for every each of two or more of said radio courses over the communications-partner pointA wireless communication method computing an index value which expresses an optimal degree of radio quality of each radio course to a partner communication destination based on hour corresponding of each radio course over this computed partner communication destination.

[Claim 6]Based on said computed index valueoptimal radio course with this communications-partner point is determined about each of two or more radio courses between the communications-partner points which are going to communicateWhile choosing this determined optimal radio course and performing the communications-partner point and radioDuring this radiosaid index value is computed one by one about each of two or more radio courses between the communications-partner pointsThe wireless communication method according to claim 5 performing said communications-partner point and radio being based on this computed index valuecarrying out sequential decision of the optimal radio course with the communications-partner point during radioand making during radio the sequential selection of this optimal radio course by which sequential decision is carried out.

[Claim 7]The wireless communication method according to claim 5 or 6wherein processing which computes said index value computes said index value based on time series data of hour corresponding of each radio course to said computed partner communication destination.

[Claim 8]Processing which computes an index value based on said time series dataThe wireless communication method according to claim 7wherein hour corresponding chooses two or more hour corresponding below a predetermined value and computes an index value based on this selected hour corresponding among the newest hour correspondingtwo or more newest hour correspondingor two or more newest hour corresponding among said time series data.

[Claim 9]It is a wireless communication program which communicates while choosing optimal courseA test signal is transmitted from a communicating agency this communication origin to the communications-partner point via each of two or more radio courses between the communications-partner pointsA reply signal over said test signal replied via each of two or more of said radio courses from the communications-partner point is receivedHour corresponding from transmission of said test signal to reception of a reply signal is computed for every each of two or more of said radio courses over the communications-partner pointA wireless communication program computing an index value which expresses an optimal degree of radio quality of each radio course to a partner communication destination based on hour corresponding of each radio course over this computed partner communication destination.

[Claim 10]Based on said computed index valueoptimal radio course with this communications-partner point is determined about each of two or more radio courses between the communications-partner points which are going to communicateWhile choosing this determined optimal radio course and performing the communications-partner point and radioDuring this radiosaid index value is computed one by one about each of two or more radio courses between the communications-partner pointsThe wireless communication program according to claim 9 performing said communications-partner point and radio being based on this computed index valuecarrying out sequential decision of the optimal radio course with the communications-partner point during radioand making during radio the sequential selection of this optimal radio course by which sequential decision is carried out.
[Claim 11]The wireless communication program according to claim 9 or 10wherein processing which computes said index value computes said index value based on time series data of hour corresponding of each radio course to said computed partner communication destination.
[Claim 12]Processing which computes an index value based on said time series dataThe wireless communication program according to claim 11wherein hour corresponding chooses two or more hour corresponding below a predetermined value and computes an index value based on this selected hour corresponding among the newest hour correspondingtwo or more newest hour correspondingor two or more newest hour corresponding among said time series data.
[Claim 13]It is the recording medium which recorded a wireless communication program which communicates while choosing optimal course and in which computer reading is possibleA test signal is transmitted from a communicating agency this communication origin to the communications-partner point via each of two or more radio courses between the communications-partner pointsA reply signal over said test signal replied via each of two or more of said radio courses from the communications-partner point is receivedHour corresponding from transmission of said test signal to reception of a reply signal is computed for every each of two or more of said radio courses over the communications-partner pointA recording medium which recorded a wireless communication program computing an index value which expresses an optimal degree of radio quality of each radio course to a partner communication destination based on hour corresponding of each radio course over this computed partner communication destination and in which computer reading is possible.
[Claim 14]Based on said computed index valueoptimal radio course with this communications-partner point is determined about each of two or more radio courses between the communications-partner points which are going to communicateWhile choosing this determined optimal radio course and performing the communications-partner point and radioDuring this radiosaid index value is computed one by one about each of two or more radio courses between the communications-partner pointsIt is based on this computed index valueand sequential decision of the optimal radio course with the communications-partner

point is carried out during radioA recording medium which recorded the wireless communication program according to claim 13 performing said communications-partner point and radio making during radio the sequential selection of this optimal radio course by which sequential decision is carried out and in which computer reading is possible.
[Claim 15]A recording medium which recorded the wireless communication program according to claim 13 or 14wherein processing which computes said index value computes said index value based on time series data of hour corresponding of each radio course to said computed partner communication destination and in which computer reading is possible.
[Claim 16]Processing which computes an index value based on said time series dataHour corresponding chooses two or more hour corresponding below a predetermined value among said time series data among the newest hour correspondingtwo or more newest hour correspondingor two or more newest hour correspondingA recording medium which recorded the wireless communication program according to claim 15 computing an index value based on this selected hour corresponding and in which computer reading is possible.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the recording medium which recorded the radio communication equipment and the method of communicating while choosing the optimal coursethe wireless communication programand this program and in which computer reading is possible.
[0002]
[Description of the Prior Art]The radio through a wireless network tends to be influenced by weather conditionan obstacleetc.andunlike the wire communication by a wired networkthe radio quality changes every moment. Thereforeeven if it determines wireless communications lines onceduring radioit is influenced by weather conditionan obstacleetc.or abnormalities occurand radio sometimes stops plentifully.
[0003]Thereforein order to perform radioas a conventional path control protocol which it is important to choose the optimal radio course and performs such channel selectionFor examplethere are RIP (Routing Information protocol) and OSPF (Open Shortest Path First). In RIPpath control is performed so that smallest possible number of routers may be passed. In OSPFthe dignity in consideration of a throughputreliabilityetc. can be attached to each linkand a course is chosen so that this dignity may become small.
[0004]For example JP2001-136178AAs a path control method which specialized in the unstable wireless networkline quality transmits a course investigation frame to two or more courses from a transmitting side radio communications system before

data transmissionand the method of judging the course first received at a receiver or the transmitting side to be the best course is indicated.
[0005]
[Problem(s) to be Solved by the Invention]By RIPsince neither line speed nor reliability is taken into consideration only paying attention to the number of the routers via which it goesthere is a problem that it is not necessarily the optimal course when the selected course not necessarily takes a data transfer rate and reliability into consideration among the conventional methods mentioned above.
[0006]In OSPFalthough a throughput and reliability are taken into considerationin order not to take into consideration the data transfer rate or reliability at the time of actually communicatingwhen the selected course not necessarily communicates actuallythere is a problem that it is not necessarily the optimal course.
[0007]In the conventional method currently indicated to JP2001-136178A. Unless the abnormalities of a circuit will be detected during data communications once it determines a course in order to conduct investigation to each course only once before data transmissionSince a course is immobilizationit is not always a course in which the selected course of under data communications is also the optimal muchand there is a problem that it may be said that communication stops in response to the influence of a weather conditionan obstacleetc. during data communications.
[0008]The place which this invention was made in view of the aboveand is made into the purposeThe index value which expresses the optimal degree of the radio quality of each course from the hour corresponding of two or more courses between the communications-partner points is computedIt is in providing the recording medium which recorded the radio communication equipment and the method of performing radiothe wireless communication programand this program and in which computer reading is possiblechoosing the optimal course based on this index value.
[0009]
[Means for Solving the Problem]In order to attain the above-mentioned purposethis invention according to claim 1A test signal transmitting means which is radio communication equipment which communicates while choosing optimal courseand transmits a test signal from this radio communication equipment to the communications-partner point via each of two or more radio courses between this radio communication equipment and the communications-partner pointA reply signal reception means which receives a reply signal over said test signal replied via each of two or more of said radio courses from the communications-partner pointA hour corresponding calculating means which computes hour corresponding from transmission of said test signal to reception of a reply signal for every each of two or more of said radio courses over the communications-partner pointLet it be a gist to have an index value calculating means which computes an index value which expresses an optimal degree of radio quality of each radio course to a partner communication destination based on hour corresponding of each radio course over this computed partner communication destination.

[0010]If it is in this invention according to claim 1a test signal is transmitted to the communications-partner point via each of two or more radio courses between the communications-partner pointsReceive a reply signal from the communications-partner pointand hour corresponding from transmission of a test signal to reception of a reply signal is computed for every each of two or more coursesSince an index value which expresses an optimal degree of radio quality of each course to a partner communication destination based on hour corresponding of each of this course is computeddata communications can be performed with high reliability by choosing a course based on this index value using a course with optimal radio quality.
[0011]An optimal-path determination means to determine optimal radio course with this communications-partner point based on said index value which this invention according to claim 2 computed by said index value calculating means in the invention according to claim 1 about each of two or more radio courses between the communications-partner points which are going to communicateWhile choosing this determined optimal radio course and performing the communications-partner point and radioIt controls to compute said index value one by one by said index value calculating means during this radio about each of two or more radio courses between the communications-partner pointsDuring communication which is based on this computed index value and carries out sequential decision of the optimal radio course with the communications-partner point during radioan optimal-path sequential decision meansLet it be a gist to have said communications-partner point and an optimal-path sequential-selection means to perform radiomaking during radio the sequential selection of this optimal radio course by which sequential decision is carried out.
[0012]If it is in this invention according to claim 2while determining optimal course with the communications-partner point based on an index value computed about each of two or more courses between the communications-partner pointschoosing this determined optimal course and performing the communications-partner point and radioDuring radioan index value is computed one by one about each of two or more radio courses between the communications-partner pointsIn order to perform the communications-partner point and radiodetermining optimal course with the communications-partner point based on this index valueand making the sequential selection of this optimal course during radioData communications can be performed with high reliability in this optimal selected coursechoosing always optimal course during radio.
[0013]This invention according to claim 3 makes it a gist to have a time-series-data conformity means by which said index value calculating means computes said index value based on time series data of hour corresponding of each radio course to said computed partner communication destination in the invention according to claim 1 or 2.
[0014]In the invention according to claim 3this invention according to claim 4 said time-series-data conformity meansAmong said time series dataamong the newest hour correspondingtwo or more newest hour correspondingor two or more newest

hour correspondinghour corresponding chooses two or more hour corresponding below a predetermined valueand makes it a gist to have a data selection means which computes an index value based on this selected hour corresponding.
[0015]This invention according to claim 5 is a wireless communication method which communicates while choosing optimal courseA test signal is transmitted from a communicating agency this communication origin to the communications-partner point via each of two or more radio courses between the communications-partner pointsA reply signal over said test signal replied via each of two or more of said radio courses from the communications-partner point is receivedHour corresponding from transmission of said test signal to reception of a reply signal is computed for every each of two or more of said radio courses over the communications-partner pointLet it be a gist to compute an index value which expresses an optimal degree of radio quality of each radio course to a partner communication destination based on hour corresponding of each radio course over this computed partner communication destination.
[0016]If it is in this invention according to claim 5a test signal is transmitted to the communications-partner point via each of two or more radio courses between the communications-partner pointsReceive a reply signal from the communications-partner pointand hour corresponding from transmission of a test signal to reception of a reply signal is computed for every each of two or more coursesSince an index value which expresses an optimal degree of radio quality of each course to a partner communication destination based on hour corresponding of each of this course is computeddata communications can be performed with high reliability by choosing a course based on this index value using a course with optimal radio quality.
[0017]This invention according to claim 6 determines optimal radio course with this communications-partner point based on said index value computed in the invention according to claim 5 about each of two or more radio courses between the communications-partner points which are going to communicateWhile choosing this determined optimal radio course and performing the communications-partner point and radioDuring this radiosaid index value is computed one by one about each of two or more radio courses between the communications-partner pointsIt is based on this computed index valueand sequential decision of the optimal radio course with the communications-partner point is carried out during radioand it is considered as a performing-said communications-partner point and radio gistmaking during radio the sequential selection of this optimal radio course by which sequential decision is carried out.
[0018]If it is in this invention according to claim 6while determining optimal course with the communications-partner point based on an index value computed about each of two or more courses between the communications-partner pointschoosing this determined optimal course and performing the communications-partner point and radioDuring radioan index value is computed one by one about each of two or more radio courses between the communications-partner pointsIn order to perform the communications-partner point and radiodetermining optimal course

with the communications-partner point based on this index valueand making the sequential selection of this optimal course during radioData communications can be performed with high reliability in this optimal selected coursechoosing always optimal course during radio.

[0019]This invention according to claim 7 makes it a gist for processing which computes said index value to compute said index value based on time series data of hour corresponding of each radio course to said computed partner communication destination in the invention according to claim 5 or 6.

[0020]Processing in which this invention according to claim 8 computes an index value in the invention according to claim 7 based on said time series dataAmong said time series dataamong the newest hour correspondingtwo or more newest hour correspondingor two or more newest hour correspondinghour corresponding chooses two or more hour corresponding below a predetermined valueand makes it a gist to compute an index value based on this selected hour corresponding.

[0021]This invention according to claim 9 is a wireless communication program which communicates while choosing optimal courseA test signal is transmitted from a communicating agency this communication origin to the communications-partner point via each of two or more radio courses between the communications-partner pointsA reply signal over said test signal replied via each of two or more of said radio courses from the communications-partner point is receivedHour corresponding from transmission of said test signal to reception of a reply signal is computed for every each of two or more of said radio courses over the communications-partner pointLet it be a gist to compute an index value which expresses an optimal degree of radio quality of each radio course to a partner communication destination based on hour corresponding of each radio course over this computed partner communication destination.

[0022]If it is in this invention according to claim 9a test signal is transmitted to the communications-partner point via each of two or more radio courses between the communications-partner pointsReceive a reply signal from the communications-partner pointand hour corresponding from transmission of a test signal to reception of a reply signal is computed for every each of two or more coursesSince an index value which expresses an optimal degree of radio quality of each course to a partner communication destination based on hour corresponding of each of this course is computeddata communications can be performed with high reliability by choosing a course based on this index value using a course with optimal radio quality.

[0023]This invention according to claim 10 determines optimal radio course with this communications-partner point based on said index value computed in the invention according to claim 9 about each of two or more radio courses between the communications-partner points which are going to communicateWhile choosing this determined optimal radio course and performing the communications-partner point and radioDuring this radiosaid index value is computed one by one about each of two or more radio courses between the communications-partner pointsLet it be a gist to perform said communications-partner point and radiobeing based on

this computed index valuecarrying out sequential decision of the optimal radio course with the communications-partner point during radioand making during radio the sequential selection of this optimal radio course by which sequential decision is carried out.

[0024]If it is in this invention according to claim 10based on an index value computed about each of two or more courses between the communications-partner pointsoptimal course with the communications-partner point is determinedWhile choosing this determined optimal course and performing the communications-partner point and radioDuring radioan index value is computed one by one about each of two or more radio courses between the communications-partner pointsIn order to perform the communications-partner point and radiodetermining optimal course with the communications-partner point based on this index valueand making the sequential selection of this optimal course during radioData communications can be performed with high reliability in this optimal selected coursechoosing always optimal course during radio.

[0025]This invention according to claim 11 makes it a gist for processing which computes said index value to compute said index value based on time series data of hour corresponding of each radio course to said computed partner communication destination in the invention according to claim 9 or 10.

[0026]In the invention according to claim 11 this invention according to claim 12Hour corresponding of the newest [processing / which computes an index value based on said time series data] among said time series dataOr among two or more newest hour corresponding or two or more newest hour correspondinghour corresponding chooses two or more hour corresponding below a predetermined valueand makes it a gist to compute an index value based on this selected hour corresponding.

[0027]This invention according to claim 13 is a recording medium which recorded a wireless communication program which communicates while choosing optimal course and in which computer reading is possibleA test signal is transmitted from a communicating agency this communication origin to the communications-partner point via each of two or more radio courses between the communications-partner pointsA reply signal over said test signal replied via each of two or more of said radio courses from the communications-partner point is receivedHour corresponding from transmission of said test signal to reception of a reply signal is computed for every each of two or more of said radio courses over the communications-partner pointLet it be a gist to record a wireless communication program which computes an index value which expresses an optimal degree of radio quality of each radio course to a partner communication destination based on hour corresponding of each radio course over this computed partner communication destination on a recording medium in which computer reading is possible.

[0028]If it is in this invention according to claim 13a test signal is transmitted to the communications-partner point via each of two or more radio courses between the communications-partner pointsReceive a reply signal from the

communications-partner pointand hour corresponding from transmission of a test signal to reception of a reply signal is computed for every each of two or more coursesSince a wireless communication program which computes an index value which expresses an optimal degree of radio quality of each course to a partner communication destination based on hour corresponding of each of this course is recorded on a recording medium in which computer reading is possiblethat distributivity can be improved using this recording medium.

[0029]In the invention according to claim 13 this invention according to claim 14Based on said computed index valueoptimal radio course with this communications-partner point is determined about each of two or more radio courses between the communications-partner points which are going to communicateWhile choosing this determined optimal radio course and performing the communications-partner point and radioDuring this radiosaid index value is computed one by one about each of two or more radio courses between the communications-partner pointsIt is based on this computed index valueand sequential decision of the optimal radio course with the communications-partner point is carried out during radioLet it be a gist to record a wireless communication program which performs said communications-partner point and radio on a recording medium in which computer reading is possiblemaking during radio the sequential selection of this optimal radio course by which sequential decision is carried out.

[0030]If it is in this invention according to claim 14based on an index value computed about each of two or more courses between the communications-partner pointsoptimal course with the communications-partner point is determinedWhile choosing this determined optimal course and performing the communications-partner point and radioDuring radioan index value is computed one by one about each of two or more radio courses between the communications-partner pointsSince a wireless communication program which performs the communications-partner point and radio is recorded on a recording medium in which computer reading is possibledetermining optimal course with the communications-partner point based on this index valueand making the sequential selection of this optimal course during radioThe distributivity can be improved using this recording medium.

[0031]In the invention according to claim 13 or 14 this invention according to claim 15Let it be a gist to record a wireless communication program in which processing which computes said index value computes said index value based on time series data of hour corresponding of each radio course to said computed partner communication destination on a recording medium in which computer reading is possible.

[0032]In the invention according to claim 15processing which computes an index value based on said time series data this invention according to claim 16Hour corresponding chooses two or more hour corresponding below a predetermined value among said time series data among the newest hour correspondingtwo or more newest hour correspondingor two or more newest hour correspondingLet it

be a gist to record a wireless communication program which computes an index value based on this selected hour corresponding on a recording medium in which computer reading is possible.
[0033]
[Embodiment of the Invention]Hereafteran embodiment of the invention is described using a drawing. Drawing 1 is a block diagram showing the composition of the radio communication equipment concerning one embodiment of this invention. The radio communication equipment 100 shown in the figure transmits the test frame which is a test signal to this communications-partner point via two or more radio courses between the communications-partner pointsOn the other handthe response test frame to the test frame returned from the communications-partner point is receivedThe index value which expresses the optimal degree of the radio quality of each course to a partner communication destination based on the time series data of the hour corresponding from transmission of this test frame to reception of a response test frame or this hour corresponding is computedWhile choosing the optimal course with the communications-partner point based on this index value and performing the communications-partner point and radio by this optimal pathWhile performing radio and controlling the whole operationmaking the sequential selection of the optimal course between these communications-partner points during radioit has the control section 1 which performs calculation of generation of said test framehour correspondingand an index valueselection of an optimal pathetc. As for radio communication equipmentin order to choose the optimal course and to transmit a test frame to each course over the communications-partner pointit is a matter of course that it is what saves all the information on two or more courses of receiving the communications-partner point.
[0034]The radio communication equipment 100 transmits the data to the radio communication equipment of the communications-partner point as an electric waveorThe data frame containing the antenna 7 which receives the data from the communications-partner point as an electric wavethe switch 5 which changes the transmission and reception of data to this antenna 7and the test frame generated by the control section 1 via the switch 5 and the antenna 7. It has the transmission section 3 which transmits to the communications-partner pointand the receive section 9 which receives the data frame containing the response test frame to the test frame from the communications-partner point via the antenna 7 and the switch 5.
[0035]The test frame which created the radio communication equipment 100 by the control section 1The transceiver buffer 11 which accumulates temporarily data framessuch as a response test frame to the test frame received from the communications-partner pointThe index value showing the optimal degree of the radio quality of each course between the communications-partner points computed by the control section 1 based on the time series data of hour corresponding and this hour corresponding concerning transmission and reception of the test frame between the communications-partner pointsand a response test

frameetc. It has the course evaluation index value database 13 to store and the external interface 15 which consists of a USB terminala PC card interfacean Ethernet terminaletc. in order to perform transmission and reception of the terminal 19 of a personal computer etc.and data. When a communication function with the terminal 19 is unnecessarythe external interface 15 is unnecessary.
[0036]The control section 1 conducts in detail the Cyclic Redundancy Check of the data receiving control section 21 controlled to receive the data frame which contains the response test frame to said test frame from the receive section 9 which showed drawing 1 as shown in drawing 2and the data frame received by this data receiving control section 21Whether the data frame has received normally. CRC (Cyclic Redundancy.) to judge The Check check part 23this inspected receiving DE The index value showing the optimal degree of the hour corresponding for every radio course and the radio quality of each courseetc. are computed from the received-data analyzing parts 25 which analyze - tough REMUand this analyzed data frame. . Based on the index value of each course computed by the hour corresponding and the course index value calculation part 27 stored in said course evaluation index value database 13and this hour corresponding and course index value calculation part 27I will carry out a data transmission start. The optimal-path evaluation and the selecting part 29 which evaluates a course based on the index value of each course to the evaluation of a course with the communications-partner point to carry outand the communications-partner point for every specified time elapse during data transmissionand makes determination selection of the optimal courseIn order to carry out selection evaluation of the optimal course from each course over the data frame and the communications-partner point which transmit to the communications-partner point via this optimal selected course. While notifying the transmission time which should be written in to the send data preparing part 31 which creates the send data containing the test frame etc. which are the test signals transmitted via each course to the communications-partner pointand the test frame which it is created in this send data preparing part 31and is going to transmitThe timer 33 which notifies the receipt time which should be written in to the response test frame to the test frame received by said data receiving control section 21It has the data transmission control section 35 controlled to transmit the data frame created by said send data preparing part 31 to the communications-partner point via said transmission section 3the switch 5and the antenna 7.
[0037]The data receiving control section 21 investigates whether the data frame received from the receive section 9 is a thing addressed to itselfand when it is not addressing to itselfthe function which investigates a course and transmits to the radio communication equipment which is the following node also has it. The received-data analyzing parts 25 have the function to identify whether a receiving data frame is a response test frame to a test frame furtheror it is the usual data frame.
[0038]Hour corresponding and the course index value calculation part 27 control

the send data preparing part 31 to write the transmission time from the timer 33 in this test framewhen it is going to transmit a test frame from the data transmission control section 35 furtherorControl to write the receipt time from the timer 33 in the response test frame to the test frame received by the data receiving control section 21orBased on the transmission time of a test frameand the receipt time of a response test framethe hour corresponding from transmission of a test frame to reception of a response test frame is computed for every each of two or more courses of receiving the communications-partner pointWhile storing in the course evaluation index value database 13 by making hour corresponding for every course into time series dataThe index value which expresses the optimal degree of the radio quality of each course to a partner communication destination based on the time series data of the hour corresponding stored in the hour corresponding of each course of the communications-partner point and the course evaluation index value database 13 which were computed in this way is computedIt has a function stored in the course evaluation index value database 13. Although hour corresponding is made into the time from transmission of a test frame to reception of a response test frame in this embodimentThe hour corresponding of one way until it is not limited to thisit transmits a test frame and it reaches the communications-partner pointor the hour corresponding of one way from the reply from the communications-partner point to arrival may be sufficient.

[0039]Optimal-path evaluation and the selecting part 29While performing the optimal-path selection process which chooses the optimal course over the communications-partner point based on the index value stored in the index value and the course evaluation index value database 13 which were computed by hour corresponding and the course index value calculation part 27 at the time of the data frame transmission start to the communications-partner pointDuring transmission of a data framehour corresponding and an index value are computed one by one about each course between the communications-partner pointsand it has a function which makes the sequential selection of the optimal course with the communications-partner point based on this computed index value.

[0040]In addition to the clock function which provides the receipt time written in the response test frame received to the transmission time and the test frame which are written in a transmitting test frame as mentioned abovethe timer 33 has the function to generate the specified-time-elapse information for transmitting a test frame for every predetermined time.

[0041]The transmission section 3 and the data transmission control section 35 constitute a test signal transmitting meansand the receive section 9 and the data receiving control section 21 constitute a reply signal reception means. Hour corresponding and the course index value calculation part 27 constitute a hour corresponding calculating means and an index value calculating means. Hour corresponding and the course index value calculation part 27 also have a function which computes the index value which expresses the optimal degree of the radio quality of each course to a partner communication destination based on the time series data of the hour corresponding stored in the course evaluation index value

database 13as mentioned abovebut. The function of this hour corresponding and course index value calculation part 27 constitutes the time-series-data conformity means. Optimal-path evaluation and the selecting part 29 constitute an optimal-path serial setting-out means and an optimal-path sequential-selection means during an optimal-path determination means and communication.

[0042]Nextthe send data preparing part 31 of the control section 1 createsit transmits via each course to the communications-partner pointand the composition of the response test frame to the test frame which is a test signal replied from the communications-partner pointand this test frame is explained with reference to drawing 3.

[0043]A test frame and a response test frame comprise a frame typeframe lengtha transmission source addressa destination addressa coursea both-way identifieroutward trip frame transmission timereturn trip frame reception timea data divisionand CRCas shown in drawing 3.

[0044]It is shown that a frame type is a different test frame from the usual data frame. Frame length shows the length of the data division of the test frame concerned. A transmission source address and a destination address are an address of the transmitting sideand an address of a receiverrespectively. Although one of two or more of the radio courses in which a course receives the communications-partner point is written infor this reasononly the number of the courses of plurality [test frame] will be created.

[0045]The information which shows whether both-way identifiers are whether a test frame is an outward trip and a return trip is written in. That isit will be written in the response test frame to the test frame replied from the communications-partner point at the both-way identifier that it is a return trip. In outward trip frame transmission timethe transmission time of an outward trip test frame is writtenand the receipt time of a return trip test frame is written in return trip frame reception time. The data of fixed length [data division] is written in and the bit for Cyclic Redundancy Checks is written in CRC.

[0046]The usual data frame does not have a both-way identifieroutward trip frame transmission timeand return trip frame reception time among the test frames shown in drawing 3as shown in drawing 4.

[0047]Nextwith reference to drawing 8the operation which communicates while choosing the optimal course with the radio communication equipment of this embodiment is explained.

[0048]As shown in drawing 8two or more coursesthe course 100 which goes only via the radio communication equipment 120 as an example in drawing 8and the course 200 which goes via the radio communication equipments 140 and 150 exist in the wireless network between the transmitting side radio communication equipment 110 and the receiver radio communication equipment 130. Thenin order to choose the optimal course among two or more courses in transmitting a data frame to the receiver radio communication equipment 130 from the transmitting side radio communication equipment 110The transmitting side radio communication equipment 110Based on the specified-time-elapse information

outputted for every predetermined timerepeating transmission of the test frame which is a test signal is carried out from the timer 33 for every predetermined time to the receiver radio communication equipment 130 via each of two or more courses 100200 which receives the receiver radio communication equipment 130.
[0049]The receiver radio communication equipment 130 will reply the response test frame to this received test frame via the same routeif the test frame from the transmitting side radio communication equipment 110 is received. Namelythe receiver radio communication equipment 130 replies a response test frame to the transmitting side radio communication equipment 110 via the same course 100when a test frame is received via the course 100When the receiver radio communication equipment 130 receives a test frame via the course 200a response test frame is replied to the transmitting side radio communication equipment 110 via the course 200.
[0050]The transmitting side radio communication equipment 110 will calculate the hour corresponding from transmission of said test frame to reception of a response test frameif the response test frame replied from the receiver radio communication equipment 130 is received.
[0051]And while the radio communication equipment 100 repeats operation from transmission of the test frame mentioned above to reception of a response test frame about each of two or more courses of a before [from the transmitting side radio communication equipment 110 / the receiver radio communication equipment 130] and performs itThis repetition processing is repeatedly performed based on the specified-time-elapse information outputted for every predetermined time for every predetermined time from the timer 33Thusit stores in the course evaluation index value database 13 for each [from the transmitting side radio communication equipment 110 to the receiver radio communication equipment 130] course of every by making into time series data hour corresponding from transmission of the test frame computed by having performed repeatedly for every predetermined time to reception of a response test frame.
[0052]The hour corresponding and the course index value calculation part 27 of the control section 1The index value which expresses the optimal degree of the radio quality of each course to the receiver radio communication equipment 130 from the transmitting side radio communication equipment 110 based on the time series data of the hour corresponding for every course stored in the hour corresponding for every course and the course evaluation index value database 13 which were computed as mentioned above is computedThis computed index value is stored in the course evaluation index value database 13 for every course. Thereforethe optimal course of the transmitting side radio communication equipment 110 to the receiver radio communication equipment 130 can be determined by referring to the index value stored in the course evaluation index value database 13 for every course in this way.
[0053]Soin performing actual data communicationsthe transmitting side radio communication equipment 110Based on the time series data of the hour corresponding stored in the course evaluation index value database 13the optimal

radio course over the receiver radio communication equipment 130 is determinedand data will be transmitted to the receiver radio communication equipment 130choosing this optimal course.
[0054]The transmission of a test frame performed for every predetermined time as it mentioned aboveeven if the transmitting side radio communication equipment 110 came during such data transmissionRepeat and continue for every predetermined time and calculation of reception of the response test frame from the receiver radio communication equipment 130hour correspondingand an index value is performedIt always searches for the optimal course continuouslyand when the course more nearly optimal than the course used now is detecteddata communications are continued via the optimal course.
[0055]Nextwith reference to the flow chart shown in drawing 5 and drawing 6an operation of the radio communication equipment of this embodiment is explained briefly.
[0056]Firstwith reference to drawing 5reception of a response test frame and calculation processing of hour corresponding and an index value are explained from transmission of a test frame.
[0057]In drawing 5transmitting side radio communication equipment transmits a test frame to each of two or more courses which receives receiver radio communication equipment (Step S11). Receiver radio communication equipment will reply the response test frame to this test frame by the same routeif the test frame transmitted from transmitting side radio communication equipment is received (Step S13).
[0058]If transmitting side radio communication equipment is received [a response test frame] from receiver radio communication equipmentwhile calculating the hour corresponding from transmission of a test frame to reception of a response test frame by hour corresponding and the course index value calculation part 27This calculated hour corresponding is stored in the course evaluation index value database 13 as time series data for every course (Step S15).
[0059]The index value for evaluating the optimal course based on the time series data of the hour corresponding of each course stored in the course evaluation index value database 13 as transmitting side radio communication equipment was mentioned aboveNamelythe index value showing the optimal degree of the radio quality of each course is computed by hour corresponding and the course index value calculation part 27and this computed index value is stored in the course evaluation index value database 13 for every course (Step S17). The above processing will be repeatedly performed based on the predetermined time channel information outputted for every predetermined time from the timer 33 for every fixed time lapse which is predetermined time (Step S19)and the hour corresponding for every course and the time series data of an index value will be stored in the course evaluation index value database 13 by this.
[0060]Nextwith reference to drawing 6the operation in the case of actually transmitting data to receiver radio communication equipment from transmitting side radio communication equipment is explainedchoosing the optimal course

based on the hour corresponding for every course and the time series data of an index value which were stored in the course evaluation index value database 13as mentioned above.

[0061]In drawing 6when transmitting side radio communication equipment actually transmits data to receiver radio communication equipmentWith reference to the index value for every course over the receiver radio communication equipment stored in the course evaluation index value database 13 (Step S21)the index value of each course is compared and the optimal course is chosen (Step S23).

[0062]Transmitting side radio communication equipment will transmit data to receiver radio communication equipment via this optimal courseif the optimal course over receiver radio communication equipment is chosen (Step S25). And confirm whether be during transmission of datawhen it is not during transmission of data (i.e.when data transmission is completed)end this processingbut. Confirm whether when it was under transmissionfixed time passed (Step S29)when not having passedreturn to Step S25and continue transmission of this databut. When fixed time passesit returns to Step S21the same processing for choosing the optimal course over receiver radio communication equipment is repeatedand is performedthis searches for the still more nearly optimal course also in data transmissionand data transmission is performed in the always optimal course.

[0063]The fixed time which is a time interval which carries out transmission etc. of the test frame mentioned aboveSince it stops reflecting the newest course state to becoming the increase in the traffic to a wireless network if not much shortand applying a burden to a network when too longAlthough being determined in consideration of both is desirable and an optimum value changes with length of the test frame transmitted and received1 second – about 10 seconds can be consideredfor example.

[0064]As a calculating method of the index value for evaluating the optimal course mentioned aboveThe 1st method of computing an index value using the newest hour correspondingthe 2nd method of computing an index value among time series data using two or more newest hour correspondingOr in two or more hour corresponding of the newest of the time series datatwo or more hour corresponding below predetermined hour corresponding is chosenand there are the 3rd method of computing an index value based on two or more of these selected air timeetc.

[0065]As for the index value computed by the 1st methodonly the last bit rate will be reflectedas for the index value computed by the 2nd methodthe latest data transmission speed and the reliability of a communication line will be reflectedandas for the index value computed by the 3rd methodthe reliability of the latest communication line will be reflected.

[0066]Nextwith reference to drawing 7a detailed operation of the control section 1 of the radio communication equipment 100 of this embodiment is explained.

[0067]Firstthe control section 1 is in charge of creation of send dataand creates the frame which contains a transmission source addressa destination addressand send data based on a frame format in the send data preparing part 31. And in

creating a test frame at this time. While creating route data with reference to the channel information database (DB) 51 set as the radio communication equipment which is a node beforehand and writing in as a course of a test frameThe time information from the timer 33 is acquiredand this time information is written in the outward trip frame transmission time of a test frameand also a both-way identifier is set as an outward tripand a test frame is created.

[0068]And if the test frame created in this way is once written in the transceiver buffer 11 (Step S71) and the notice of fixed time lapse is received from the timer 33This test frame is read from the transceiver buffer 11and it transmits to receiver radio communication equipment according to the course currently written in the test frame via the transmission section 3the switch 5and the antenna 7 from the data transmission control section 35.

[0069]If the data receiving control section 21 of the control section 1 receives a framethis frame is once stored in the transceiver buffer 11 (Step S81)CRC check is performed in the CRC-check part 23 (Step S83)and when CRC check is goodit is judged whether it is a frame addressed to itself (Step S85). In not being a frame addressed to oneselfit progresses to Step S73the course for transmitting and acting as intermediary is analyzed to the radio communication equipment which is a next nodand it transmits to a next nod from the data transmission control section 35 via this course.

[0070]On the other handin the case of the frame addressed to itselfa frame type is identifiedand it is judged to it whether it is a test frame (Step S87). In not being a test frameit transmits this frame to a moving terminalbut in being a test frameit discriminates from the both-way identifier of a test frame whether it is a return trip (Step S89).

[0071]When the both-way identifier of a test frame is an outward tripcreate a response test frame by the send data preparing part 31and reply to transmitting side radio communication equipment by making the both-way identifier of this response test frame into a return tripbut. When a both-way identifier is a return tripthe receipt time is written in a response test frame (Step S91)Based on the outward trip frame transmission time and return trip frame reception time which are written in this response test framethe hour corresponding from transmission to reception is calculated by hour corresponding and the course index value calculation part 27 (Step S93).

[0072]And this calculated hour corresponding is stored in the course evaluation index value database 13 with channel information (Step S95). Hour corresponding and the course index value calculation part 27 compute a course index value based on the time series data of the hour corresponding for every course stored in the course evaluation index value database 13 in this way (Step S97)This computed course index value is saved in the course evaluation index value database 13 for every course (Step S99).

[0073]On the other handtransmitting side radio communication equipment creates the frame which contains a transmission destination addressa destination addressand send data in the origin of control of the control section 1 based on a

frame format by the send data preparing part 31 as mentioned abovewhen transmitting the ordinary data frame which is not a test frame. And before transmitting this data framewith reference to the index value of each course once accumulated in the course evaluation index value database 13 in optimal-path evaluation and the selecting part 29an optimal path is chosen and it writes in the optimal-path data-hold part 53.

[0074]The send data preparing part 31 will redo selection of an optimal path againif creation of route data is continued and fixed time passesreferring to this dataand continues creation of route data until fixed time passes.

[0075]After creation of a transmitting data frame is completedthis data frame is once written in the transceiver buffer 11path analysis for transmitting to the radio communication equipment which is a next nod is conductedand a data frame is supplied to the data transmission control section 35. This data frame is transmitted to the communications-partner point via said optimal path via the transmission section 3the switch 5and the antenna 7 from the data transmission control section 35.

[0076]Thusa data frame is transmitted to the communications-partner pointand it is also under [communications-partner point and data-communications] also settingThe radio communication equipment of this embodiment continues transmitting a test frame via each courseas mentioned aboveit computes an index value based on the hour corresponding from transmission of this test frame to receptionand is always continuing detecting [come] the optimal course based on this index value. And when the course still more nearly optimal than the course under current data communication is detectedthe present course is changed into this optimal coursedata communications are continuedand data communications can be carried out while this always chooses the optimal course also in data communications.

[0077]It records on recording mediasuch as CD and FDby considering procedure of the wireless communication method of the above-mentioned embodiment as a programBy downloading the program recorded on this recording medium to a computer system via a communication lineor installing from a recording mediumand operating a computer system by this programIt is natural that it can be made to function as radio communication equipment which enforces a wireless communication methodand the distributivity can be improved by using such a recording medium.

[0078]

[Effect of the Invention]As explained aboveaccording to this inventiona test signal is transmitted to the communications-partner point via each of two or more radio courses between the communications-partner pointsReceive a reply signal from the communications-partner pointand the hour corresponding from transmission of a test signal to reception of a reply signal is computed for every each of two or more coursesSince the index value which expresses the optimal degree of the radio quality of each course to a partner communication destination based on the hour corresponding of each of this course is computeddata communications can

be performed with high reliability by choosing a course based on this index value using a course with optimal radio quality.

[0079]While according to this invention determining the optimal course with the communications-partner point based on the index value computed about each of two or more courses between the communications-partner pointschoosing this determined optimal course and performing the communications-partner point and radioDuring radioan index value is computed one by one about each of two or more radio courses between the communications-partner pointsData communications can be performed with high reliability in this optimal coursechoosing the always optimal course during radiosince the communications-partner point and radio are performed determining the optimal course with the communications-partner point based on this index valueand making the sequential selection of this optimal course during radio.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a block diagram showing the composition of the radio communication equipment concerning one embodiment of this invention.

[Drawing 2]It is a block diagram showing the composition of the control section currently used for the radio communication equipment of the embodiment shown in drawing 1.

[Drawing 3]It is a figure showing the composition of the test frame used for the radio communication equipment of the embodiment shown in drawing 1.

[Drawing 4]It is a figure showing the composition of the usual data frame used for the radio communication equipment of the embodiment shown in drawing 1.

[Drawing 5]It is a flow chart which shows reception of a response test frame and calculation processing of hour corresponding and an index value from transmission of a test frame in the radio communication equipment of the embodiment shown in drawing 1.

[Drawing 6]It is a flow chart which actually shows the operation in the case of transmitting data to receiver radio communication equipment from transmitting side radio communication equipmentchoosing the optimal course based on the hour corresponding for every courseand the time series data of an index value in the radio communication equipment of the embodiment shown in drawing 1.

[Drawing 7]It is an explanatory view showing a detailed operation of the control section of the radio communication equipment of the embodiment shown in drawing 1.

[Drawing 8]It is an explanatory view showing the operation which communicates while choosing the optimal course with the radio communication equipment of the embodiment shown in drawing 1.

[Description of Notations]

1 Control section

3 Transmission section
9 Receive section
11 Transceiver buffer
13 Course evaluation index value database
21 Data receiving control section
27 Hour corresponding and a course index value calculation part
29 Optimal-path evaluation and a selecting part
31 Send data preparing part
33 Timer
35 Data transmission control section